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ABSTRACT

A study was undertaken to investigate the extent to which reading by students with varying skill levels is a text-driven or a concept-driven process; that is, it examined the conditions under which readers used context to identify words. The 72 second and third grade students in the study read target words that varied in decodability, frequency, and number of syllables in conditions of isolation, poor context, and moderate context. Subject factors were grade, sex, and reading ability. In general, the data indicated that good readers are predominantly text-driven, while poor readers are concept-driven and average readers fluctuate between text and concept. (Author/RL)

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Comparison of Word Identification Strategies with Varying Context, Word Type, and Reader Skill

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Abstract

The current study investigated the extent to which reading for various skill level readers is a text-driven or concept-driven process; that is, it examined the conditions under which readers use context to identify words. Subjects read target words which varied in decodability, frequency, and number of syllables in conditions of isolation, poor context, and moderate context. Subject factors were grade (second or third), sex, and reading ability (high, average, low). In general, the data indicated that good readers are predominately text-driven, while poor readers are concept-driven, and average readers fluctuate.

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Comparison of Word Identification Strategies
with Varying Context, Word Type, and Reader Skill

The role that context plays in the reading process has long been of interest to researchers. This is not surprising in that a thorough understanding of the extent to which readers utilize context to identify words would reveal the very nature of the reading process. There are few advocates today of either pure bottom-up (text-driven) or pure top-down (concept-driven) models of reading. Most theorists contend that word identification in reading is based on an interplay between the features of individual words and context cues (e.g., Rumelhart, 1976). However, it would be useful to specify the degree to which either word features and/or context features contribute to word identification. We need to know under what conditions readers directly decode words using letter-sound correspondences, spelling patterns, etc., and under what conditions such direct processing is circumvented by use of contextual cues to "predict" words. We also need to know if good and poor readers differ in their utilization of context. In other words, we need to know if the "mode" of reading is more text-driven or concept-driven, and if there are processing differences between skilled and less skilled readers.

Goodman's (1965) study indicated that first and third graders' word identification abilities were superior while reading words in context versus reading the same words in isolation, supporting a predominately concept-driven view of reading. This study fostered several studies which compared the use of context by good and poor readers. Some of these studies indicated that poor readers fail to use contextual information to the extent that good readers use it (Weber, 1970; Samuels, 1976). Other studies like

Allington (1977) found that poor readers are better at recognizing words in context than in isolation, and still other studies provide evidence that good and poor readers do not differ in their use of context (Biemiller, 1970; Coomber, 1972; Allington and Strange, 1977). Indeed, Biemiller's results suggest that poor readers fail to progress because they rely on context for word identification rather than use graphic cues. Other techniques such as cloze procedures (Wiener and Cromer, 1966; Vogel, 1975) and correlational studies on recognizing words in and out of context (Shankweiler and Lieberman, 1972) add only more contradictory results. While problems with particular research methods can be cited--e.g., use of "cloze" like procedures which may reflect pure "guessing" rather than text based use of context; use of response latencies with young children; use of correlational analysis--a more basic reason for these conflicting findings may lie in the lack of control over the stimulus materials themselves. For example, Dewitz (1978) found evidence that readers have different strategies for identifying long and short words. Pearson and Studt (1975) found that successful utilization of context is more likely with high frequency words.

The current study was designed to shed light on some of the contradictory findings on the role of context in reading by tightly controling the stimulus materials. Subjects read target words which varied in decodability (regularity of phonic patterns), frequency, and number of syllables, in conditions of isolation, poor context, and moderate context. Subject factors were grade (2nd or 3rd), sex, and ability (good, average, and poor readers). The dependent measure was correct/incorrect

pronunciation of the target words.

If reading is predominately a bottom-up, text-driven process, then we could assume that word identification is normally achieved by either systematically decoding words using letter-sound correspondences, spelling patterns, etc., or by instant recognition of words as "sight" words, and is not achieved by use of contextual cues. We should, therefore, find that factors which reflect internal word characteristics--such as decodability, frequency (as high frequency words are likely to be sight words), and number of syllables (as syllables or a close approximation to them may form a basic unit in decoding)--affect pronunciation errors, but that factors beyond the word level, such as level of contextual richness, do not. For example, we would predict fewer errors on easy decodable words than hard decodable words, and expect these errors to remain constant across context levels (e.g., expect the same number of pronunciation errors on hard decodable words whether they are in isolation, poor context, or moderate context). Finally, we would predict more errors on low frequency, hard decodable words than on any other word type, as such words are hard to decode and/or recognize by sight.

On the other hand, if reading is prediminately a top-down, "concept-driven" process in which context is used to predict words, then we should find that contextual level is more predictive of pronunciation errors than are internal word characteristics. We would,therefore, expect significantly fewer pronunciation errors with increasing contextual richness--regardless of word type (e.g., while decodability may affect pronunciation errors in isolation, there should be no significant difference between errors on

easy and hard words in moderate context). One allowable exception might be a continued frequency effect across context levels. Given the results of Pearson and Studt (1975), a case could be made for frequency affecting pronunciation errors in a concept-driven model; utilization of context is dependent on response availability, and low frequency words may be less "available." However, Fredericksen (1978) suggested that readers could employ context in two ways: 1) Utilization of context could, in what is termed a "parallel system" render all items within the context-relevant domain more accessible (i.e., there should be no difference between high and low frequency words), or 2) Utilization of context could, in what is termed a "serial system,"involve prediction of one likely word which is submitted to verification testing, before selection of other alternatives (i.e., high frequency words are more likely responses and thus should cause fewer errors than low frequency words, particularly in moderate context). This latter prediction is equivalent to that of Pearson and Studt.

The current study thus examined the following hypotheses:

1) If reading is prediminately a text-driven process, then:
   a) There should be significantly fewer errors on easy decodable words than hard decodable words, and these errors should remain constant across context levels.
   b) There should be significantly fewer errors on one syllable words than two syllable words and these errors should remain constant across context levels.
   c) There should be significantly fewer errors on high frequency words than low frequency words, and these errors should remain constant across context levels.

d) There should be significantly more errors on low frequency, hard decodable words than any other word type, and these errors should remain constant across context levels.

2) If reading is predominately a concept-driven process, then:

a) There should be less effect of decodability in poor context than in isolation, and there should be no significant difference between errors on easy and hard decodable words in moderate context.

b) There should be less effect of syllables in poor context than in isolation, and there should be no significant difference between errors on one and two syllable words in moderate context.

c) If utilization of context is "parallel," there should be no significant difference between errors on high and low frequency words in poor or moderate context.

d) If utilization of context is "serial," there should be significantly fewer errors on high frequency words than on low frequency words of any type (i.e., equal number of errors on low frequency, hard decodable and low frequency, easy decodable words), and this effect should be strongest in moderate context.

Method

Subjects

A total of 72 subjects from a large middle class school in Austin, Texas, participated in the study. Subjects were randomly drawn from all

second and third grade children who scored between 96 and 120 on the California Test of Mental Maturity.[1] Subjects were drawn until equal numbers of females and males, second and third graders, and high, average, and low ability readers were selected who met the design requirements. Subjects were classified as high ability if they met three criteria: 1) were in the top reading group in their class, 2) scored between the 85th to 99th percentile ($\bar{x}$ = 92nd percentile) in overall reading achievement on the California Achievement Test, and 3) successfully read above grade level on a graded word list (a portion of the Interactive Reading Assessment System; Calfee and Calfee, 1977). Subjects were classified as average ability if they: 1) were in the middle reading group in their class, 2) scored between the 45th to 70th percentile on the CAT ($\bar{x}$ = 59th percentile), and 3) successfully read at grade level on the word list. Subjects were classified as low ability if they: 1) were in the bottom reading group in their class, 2) scored between the 15th and 35th percentile on the CAT ($\bar{x}$ = 29th percentile), and 3) could not read at grade level on the word list.

Materials

Forty target words were selected which represented all possible combinations of the experimental word factors (easy/hard decodable words; one/two syllable words; and high/low frequency words). Easy decodable words had only one vowel per syllable or one vowel plus a silent "e," corresponded to phonic generalizations $C\breve{V}C$, $C\bar{V}$, or $C\bar{V}CE$, and had no consonant clusters. Hard decodable words had difficult vowel patterns in at least one syllable. Examples of such patterns are vowels and vowel digraphs which do not correspond to commonly taught generalizations, such as the $C\breve{V}C$ or $\bar{V}V$ rules.

Frequency was determined by the total word frequency count of Carroll, Davies, and Richman (1971). The mean frequency for high frequency words was 292 per million, with a range from 54 to 841 per million. The mean frequency for low frequency words was 20 per million, with a range from 2 to 45 per million.

Two sentences were constructed for each target word. One sentence preceded the target word with moderate contextual cues as to its identity; the other sentence lacked such cues. All sentences had a subject-action-object sequence and were composed of words from the Harris-Jacobson Core Words List for first grade (with the exception of the target word). The target word was the last word in the sentence. Moderate context sentences had a subject and/or verb that related directly to the target word; poor context sentences lacked such relatedness. The materials appear in Table 1.

Insert Table 1 about here

The validity of the context levels was verified by using a modified cloze procedure. Thirty second and third graders read a sentence which contained the first letter of the target word followed by a space indicating its approximate length. Subjects were asked to tell the experimenter one to three words which could complete the sentence (e.g., At the zoo we saw a t____.). Moderate context sentences were those in which the target word was mentioned by at least 60% of the subjects. Poor context sentences were those which elicited the target word from fewer than 10% of the subjects. Target words and sentences were typed on 3 inch by 5 inch (7.5 cm x 12.5 cm) cards and individually shown to subjects.

Design

A 2^3 factorial design representing the two levels of decodability, syllables, and frequency, was used to develop the forty target words. Each cell in the design contained five target words (e.g., five one syllable, low frequency, easy decodable words). A 2^4 factorial design was used to develop 80 sentences; the level of contextual richness (moderate or poor) was added to the 2^3 design. Each target word was used in two sentences--one with poor context and one with moderate context. Each cell in this design contained five sentences (e.g., five moderate context sentences with a one syllable, low frequency, easy decodable word). Sentences in the 2^4 design were divided into two balanced sets to create a between-subjects blocking factor in order that subjects would not read both the moderate and poor context sentences for any one target word. Three other between-subjects factors were: Grade (2nd or 3rd); sex (male or female); and reading ability (high, average, low). Thus, the between-subjects portion of the design was a fully crossed 2^3 x 3 factorial with two levels of grade, sex, and blocking, and three ability levels.

Procedure

After the initial screening with the graded word list, subjects were tested individually in two sessions, each lasting approximately 15 minutes. In the first session, subjects read 20 target words and 20 sentences which did not contain those target words. One week later, subjects read the remaining 20 words and 20 non-corresponding sentences. In both sessions, the order of presentation for words and sentences was randomized by shuffling the stimulus cards prior to testing each subject. Likewise, the set

of cards used in the first session was determined, for each subject, by a coin toss.

Subjects were instructed to read the words and sentences on the cards as well as they could. If a subject missed a non-target word, the experimenter, after giving the subject time to figure it out, pronounced it. This occurred infrequently as the non-target words were all on the first grade level. Target words were never pronounced by the experimenter. The tester recorded any mispronunciation of a target word as an error.

Analysis of the Data

The date were analyzed by repeated measures analysis of variance performed separately for words in isolation, poor context, and moderate context. In addition, five planned orthogonal comparisons were asked for each ability level: Is there a significant difference between pronunciation errors for words in isolation versus words in context? Is there a significant difference between pronunciation errors for words in isolation versus words in moderate context? Is there a significant interaction between frequency and context level (isolation versus context)? Is there a significant difference between decodability and context level (isolation versus context)? Is there a significant interaction between syllables and context level (isolation versus context)? The significance level for all analyses was set at .01.

Results

All significant results of the analysis of variance for words in isolation, poor context, and moderate context appear in Table 2. Grade and ability both were significant with younger and/or lower ability readers

making the most errors. Sex and block were not significant.

Insert Table 2 about here

The planned comparison between pronunciation errors on words in isolation versus words in context showed a significant main effect for low ability readers $F(1,20)$ 15.4, $p < .01$; for average readers $F(1,20) = 27.4$, $p < .01$; and for high ability readers $F(1,20) = 8.8$, $p < .01$. The effect of context is shown in Figure 1. There were no significant interactions between frequency and syllable effects in isolation versus context. The interaction between decodability effects in isolation versus context was significant for each ability level: Low ability, $F(1,20) = 48.7$, $p < .01$; Average ability, $F(1,20) = 10.9$, $p < .01$; High ability $F(1,20) = 38.7$, $p < .01$. Hard decodable words benefited proportionally more from context than did easy decodable words (Figure 2).

Insert Figures 1 and 2 about here

There were significant main effects of both frequency and decodability in each context condition. However, interpretation of these effects must be qualified by consideration of the highly significant interaction between frequency and decodability in each context condition. Low frequency, hard decodable words caused considerably more errors than any other word type regardless of context condition (Figure 3).

Insert Figure 3 about here

There was a significant interaction between frequency and ability in each context condition (Figure 2). The difference between low and average ability readers was slightly greater for high frequency words than low

frequency words; the difference between high ability readers and the other two groups was considerably greater for low frequency words than high frequency words.

There was a significant interaction between decodability and ability in each context condition (Figure 2). The difference between all groups was greater for hard decodable words than easy decodable words. This difference was most striking between low ability readers and the other two groups, though the magnitude of difference decreased with moderate context.

There was not a significant main effect of syllables. There was a significant interaction between syllables and frequency in isolation and poor context (Figure 4). In these conditions, one syllable, high frequency words incur the least errors, while one syllable, low frequency words have the most errors - even more errors than two syllable, low frequency words. With moderate context, such differences are not significant.

Insert Figure 4 about here

Discussion

Several results support a predominately text-driven model of reading. As predicted by this model, decodability and frequency significantly affected pronunciation errors in each context condition (Figure 2). The frequency effect was critical in distinguishing among a text-driven, a "serial" concept-driven, and a "parallel" concept-driven model. Frequency significantly affected pronunciation errors in all context conditions, as predicted by the text-driven model. This main effect does not support a "parallel" concept-driven model. Further, high frequency words were not

significantly helped more than low frequency words by moderate context, as predicted by a "serial" concept-driven model.

The highly significant frequency by decodability interaction indicated that low frequency, hard decodable words cause more errors than other words, regardless of contextual level (Figure 3). This finding should lead to re-consideration of word recognition studies which claim an advantage for high frequency words, without controlling orthographic patterns. The interaction is also exactly the result predicted by a predominately text-driven model: words which offer few internal cues to their identity, both because they represent difficult phonetic patterns and are unlikely to be recognized by sight, cause significantly more errors than any other word type. In particular, a heavily top-down, concept-driven model could not account for the decodability effects reflected both in this interaction and the main effect of decodability. Even in the condition of moderate context where readers would be most likely to adopt a hypothesis-test strategy and not decode words, there are significant decodability effects for all readers. While moderate context may decrease the depth of decoding necessary to achieve word identification (Fredericksen, 1978) and may aid in identification of hard decodable words (decodability by context interaction); it does not, in general, appear to eliminate decoding.

While there was no main effect of syllables to offer text-driven support, the syllable by frequency interaction appears to offer comparable evidence. Sight word recognition could account for the finding that high frequency words of either syllabic length are easier than their low frequency counter parts. But we must consider why two syllable, low frequency

words caused fewer errors than one syllable, low frequency words. It is unlikely these low frequency words were recognized by many readers as sight words, so we could presume that at least in the isolation and poor context conditions, they were decoded. Two syllable words are generally longer than one syllable words and offer more graphic information. Additional graphic information would decrease errors only if readers use it, rather than context, to identify words. For example, additional length may be particularly useful when decoding hard decodable, two syllable versus hard decodable, one syllable words. In this study, hard decodable, two syllable words were defined as having at least one syllable with a difficult pronunciation pattern. In most cases, this leaves another easily decodable syllable which may provide sufficient cues for identification. If such is the case, we would also expect one syllable, hard decodable words to be more difficult than two syllable hard decodable words. While the syllable by decodability interaction was not significant, as decodability far outweighed any syllabic impact, the trend was in this direction: Mean pronunciation errors on one syllable, hard decodable words = 37%; mean pronunciation errors on two syllable, hard decodable words = 33%. However, in moderate context the syllable by frequency interaction was not significant, indicating that here, utilization of context aids identification.

The interactions of both frequency and decodability by ability suggest processing differences between readers of varying ability levels. The frequency by ability interaction indicated that high ability readers have a pronounced advantage over other readers in identifying low frequency words. This suggests either that high ability readers have a much broader

sight word vocabulary which incorporates many low frequency words, or that they have better skills with which to identify such words (e.g., decoding skills). This interaction also showed that low ability readers are slightly more disadvantaged on high frequency words than on low frequency words in comparison with average readers. Poor readers appear to lack a broad high frequency sight vocabulary. Additionally, the decodability by ability interaction indicated that low ability readers are particularly handicapped by hard decodable words. Since such words are presumed to be identified as sight words, especially when in isolation, these poor readers again seem to lack a good sight word base. However, since these readers are less disadvantaged when hard decodable words appear in moderate context, they appear to utilize contextual cues.

For most readers the significant effects of decodability, frequency, frequency by decodability, and syllables by frequency are in line with the predictions of a predominately text-driven model. However, the magnitude of all of these effects diminished with increasing levels of context and this can not be explained by a pure text-driven model. Furthermore, there was a significant difference between pronunciation errors on words in isolation versus words in context for low and average readers; and, there was a significant difference between errors in isolation and moderate context for all groups. To varied degrees, all readers appear to utilize context, but it appears that as readers become more skilled, they rely on it only when internal word cues are minimal. The pattern of errors for high ability readers is very close to that predicted by a text-driven model. These readers show little benefit from context except on low

frequency, hard decodable words. However, the pattern of errors for low ability readers indicates that they benefit considerably from context for all word types. This suggests that poor readers switch from a predominately text-driven approach while reading words in isolation, to a predominately concept-driven approach when reading words in context. However, decodability still significantly affects errors in moderate context, so it is unlikely poor readers ignore orthographic structures, but rather that they are incapable of maximizing their use. Average readers also benefit from context for all word types, but less dramatically than low ability readers. It appears these readers fluctuate when reading between text-driven and concept-driven processing.

Conclusions

Results of the current study suggest that as readers become more skilled, they read in a predominately text-driven fashion. This is not to say that good readers never use context, but that their use of it is primarily limited to cases where internal word characteristics offer minimal cues for identification (e.g., on low frequency, hard decodable words). Researchers may be mistaken in interpreting those studies which show good readers can make use of contextual cues better than poor readers as evidence that they actually do so in normal reading. It may be more efficient for good readers, with well-developed decoding skills, to directly identify words in a text-driven manner, than to "predict" words based on context. Samuels, Begy, and Chin (1976) stated about hypothesis-test models:

> The amount of time required to generate a prediction is in the neighborhood of 200 msec. Since it takes about 250 msec, or less to recognize a word in isolation, this model does not account

> for the high-speed recognition responses of fluent readers reading meaningful material. While the hypothesis/test procedure is too slow for what goes on in fluent reading, the model seems to account for intermediate levels of reading skill. (pgs. 85-86)

The current study indeed suggests that intermediate level readers may frequently be hypothesis-testers. But the results further suggest that skilled reading is predominately text-driven.

Footnotes

[1] It should be noted that CTMM I.Q.'s seem higher than those for other tests, due to a fault in norming. (See Cronbach, 1970, p. 277). Mean I.Q.'s for the groups were: High ability readers, $\bar{x}$ = 109, average ability readers, $\bar{x}$ = 106, and low ability readers, $\bar{x}$ = 102.

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Table 1

Materials

Target Word Characteristics: Easy Decodable, One Syllable, High Frequency		
Isolation	Poor Context	Moderate Context
bone	The man wants a bone.	The dog wants a bone.
cake	The boy wants a cake.	The boy eats a cake.
bus	The man sees a bus.	The man rides a bus.
rope	The girl has a rope.	The girl jumps rope.
bed	The girl has a bed.	The girl sleeps in a bed.

Target Word Characteristics: Easy Decodable, Two Syllable, High Frequency		
Isolation	Poor Context	Moderate Context
pocket	The man has a pocket.	The dress has a pocket.
pilot	In the house is a pilot.	In the airplane is a pilot.
tiger	At the school we saw a tiger.	At the zoo we saw a tiger.
market	She sees it at the market.	She gets food at the market.
rabbit	That is a rabbit.	That animal is a rabbit.

Target Word Characteristics: Easy Decodable, One Syllable, Low Frequency		
Isolation	Poor Context	Moderate Context
cot	She wants a cot.	She sleeps on a cot.
bib	The dog has on a bib.	The baby has on a bib.
ram	That is a ram.	That animal is a ram.
wig	In her hand is a wig.	On her head is a wig.
dice	We put down the dice.	We play the game with dice.

Target Word Characteristics: Easy Decodable, Two Syllable, Low Frequency		
Isolation	Poor Context	Moderate Context
bobcat	That is a bobcat.	That animal is a bobcat.
muffin	Daddy has a muffin.	Daddy eats a muffin.
mitten	She has a mitten.	On her hand is a mitten.
cupcake	She sees a cupcake.	She eats a cupcake.
jello	We want some jello.	We like to eat red jello.

Table 1 (continued)

Materials

Target Word Characteristics: Hard Decodable, One Syllable, High Frequency		
Isolation	**Poor Context**	**Moderate Context**
fruit	The girl wants some fruit.	The girl eats some fruit.
bread	He wants bread.	He eats bread.
crown	In her hand is a crown.	On her head is a crown.
chair	She is on a chair.	She sits on a chair.
hook	It is on a hook.	The fish is on the hook.

Target Word Characteristics: Hard Decodable, Two Syllable, High Frequency		
Isolation	**Poor Context**	**Moderate Context**
feathers	That animal has red feathers.	That bird has red feathers.
breakfast	We want some breakfast.	In the morning we eat breakfast.
peaches	We want peaches.	We eat peaches.
rooster	That is a rooster.	That bird is a rooster.
squirrel	That is a squirrel.	That animal is a squirrel.

Target Word Characteristics: Hard Decodable, One Syllable, Low Frequency		
Isolation	**Poor Context**	**Moderate Context**
bruise	The boy has a bruise.	The boy falls and gets a bruise.
hound	That is a hound.	That dog is a hound.
couch	She sees a couch.	She sits on a couch.
steak	We have steak.	We eat steak.
trough	He sees a trough.	The pig eats from a trough.

Target Word Characteristics: Hard Decodable, Two Syllable, Low Frequency		
Isolation	**Poor Context**	**Moderate Context**
leopard	At the school we saw a leopard.	At the zoo we say a leopard.
biscuits	We want biscuits.	We eat biscuits.
freighter	That is a freighter.	That boat is a freighter.
greyhound	That is a greyhound.	That dog is a greyhound.
ostrich	That is an ostrich.	That bird is an ostrich.

Table 2

Source	Isolation F	Isolation Mean[b]	Poor Context F	Poor Context Mean[b]	Moderate Context F	Moderate Context Mean[b]
Grade	22.9*		26.5*		15.7*	
2		29.7		27.1		22.5
3		21.8		20.6		16.3
Ability[a]	138.6*		122.2*		78.7*	
High		11.1		9.9		9.0
Average		22.0		18.2		16.5
Low		44.2		37.1		32.7
Frequency	166.5*		116.9*		91.9*	
High		18.0		15.7		12.9
Low		33.5		28.3		26.9
Decodability	163.6*		55.9*		55.1*	
Easy		16.7		16.1		12.9
Hard		34.8		32.1		25.8
Ability x Frequency[a]	7.1*		6.8*		6.1*	
High Ability						
High		6.5		6.3		5.0
Low		15.8		15.4		12.9
Average Ability						
High		11.9		8.6		9.6
Low		32.1		30.8		23.3
Low Ability						
High		35.6		31.3		24.2
Low		52.7		53.8		44.6
Ability x Decodability[a]	17.4*		6.7*		5.8*	
High Ability						
Easy		6.0		6.7		5.8
Hard		16.3		15.0		12.1
Average Ability						
Easy		14.8		13.8		9.6
Hard		29.2		26.3		23.3
Low Ability						
Easy		29.4		26.9		23.3
Hard		59.0		55.0		42.1
Syllables x Frequency	130.6*		15.2*		3.6	
High						
1		12.9		9.4		8.9
2		23.1		20.3		14.7
Low						
1		39.9		38.6		28.6
2		27.2		28.1		25.3

Table 2 continued

Source	Isolation F	Isolation Mean[b]	Poor Context F	Poor Context Mean[b]	Moderate Context F	Moderate Context Mean[b]
Frequency x Decodability	213.3*		113.1*		46.0*	
High						
Easy		16.3		15.3		10.6
Hard		19.7		14.4		13.1
Low						
Easy		17.2		16.9		15.3
Hard		49.9		49.7		38.6

* $p < .01$

$F(1,60)$, $p < .01 = 7.08$

[a] $F(2,60)$, $p < .01 = 4.98$

[b] Mean percent pronunciation errors

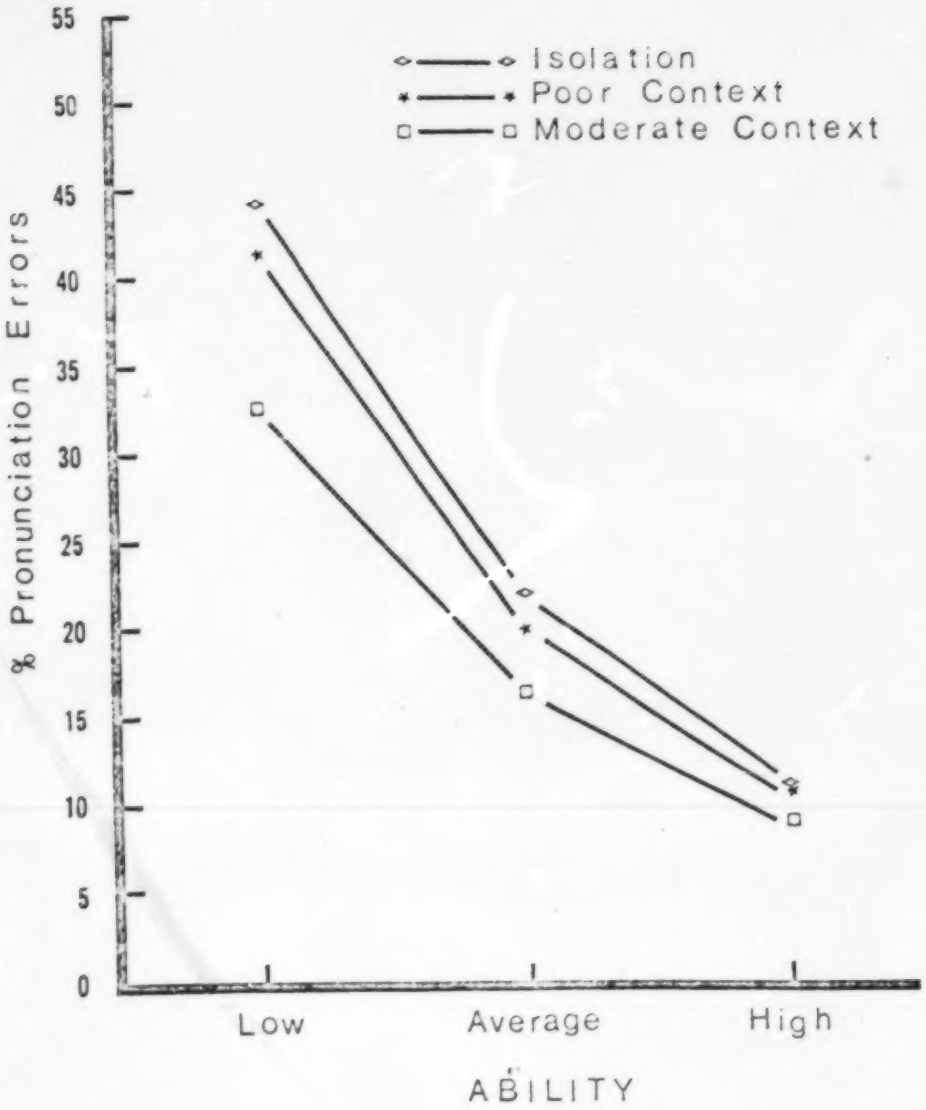

Figure 1: Context effects.

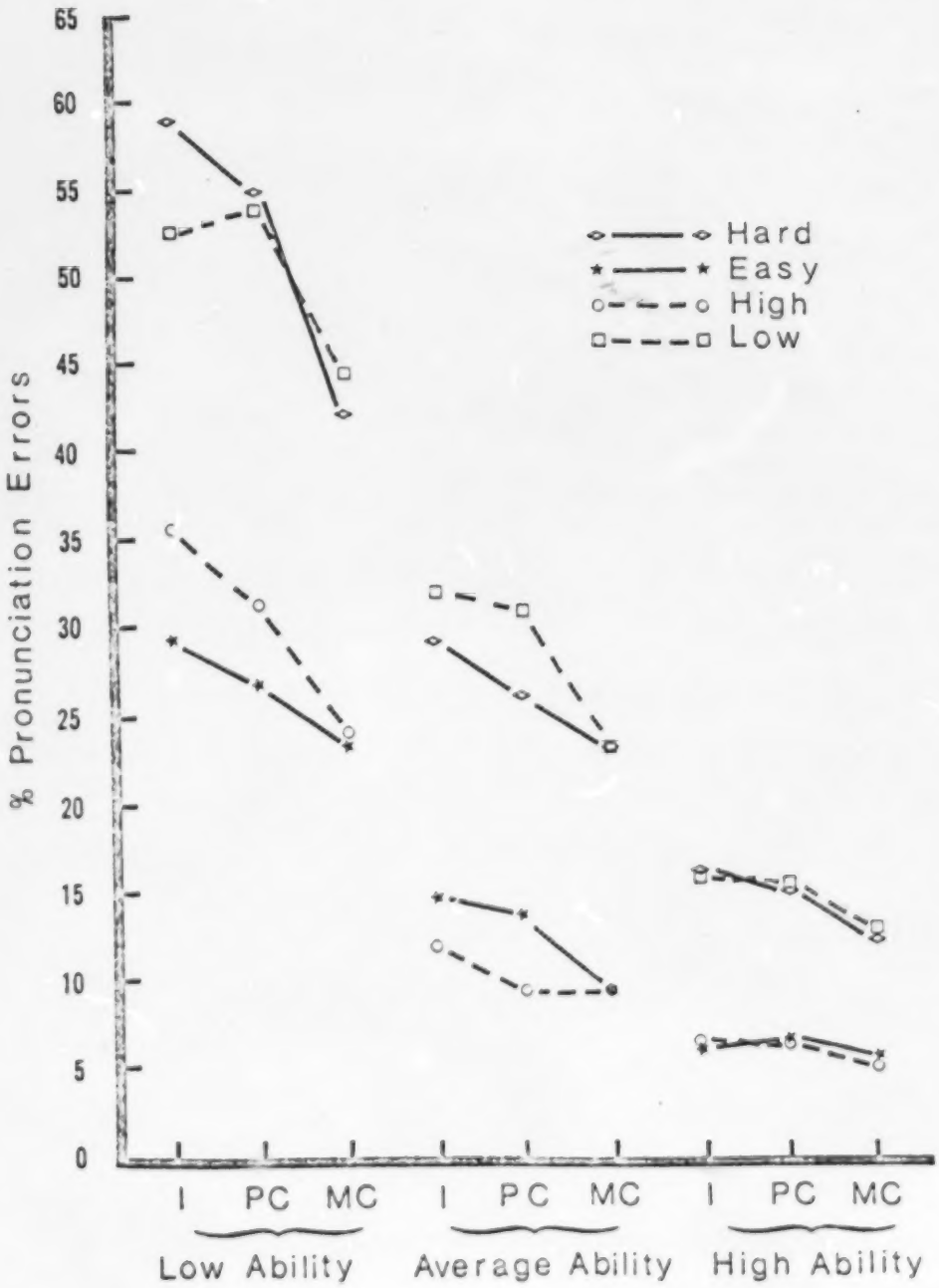

Figure 2: Decodability and frequency effects in isolation, poor context and moderate context.

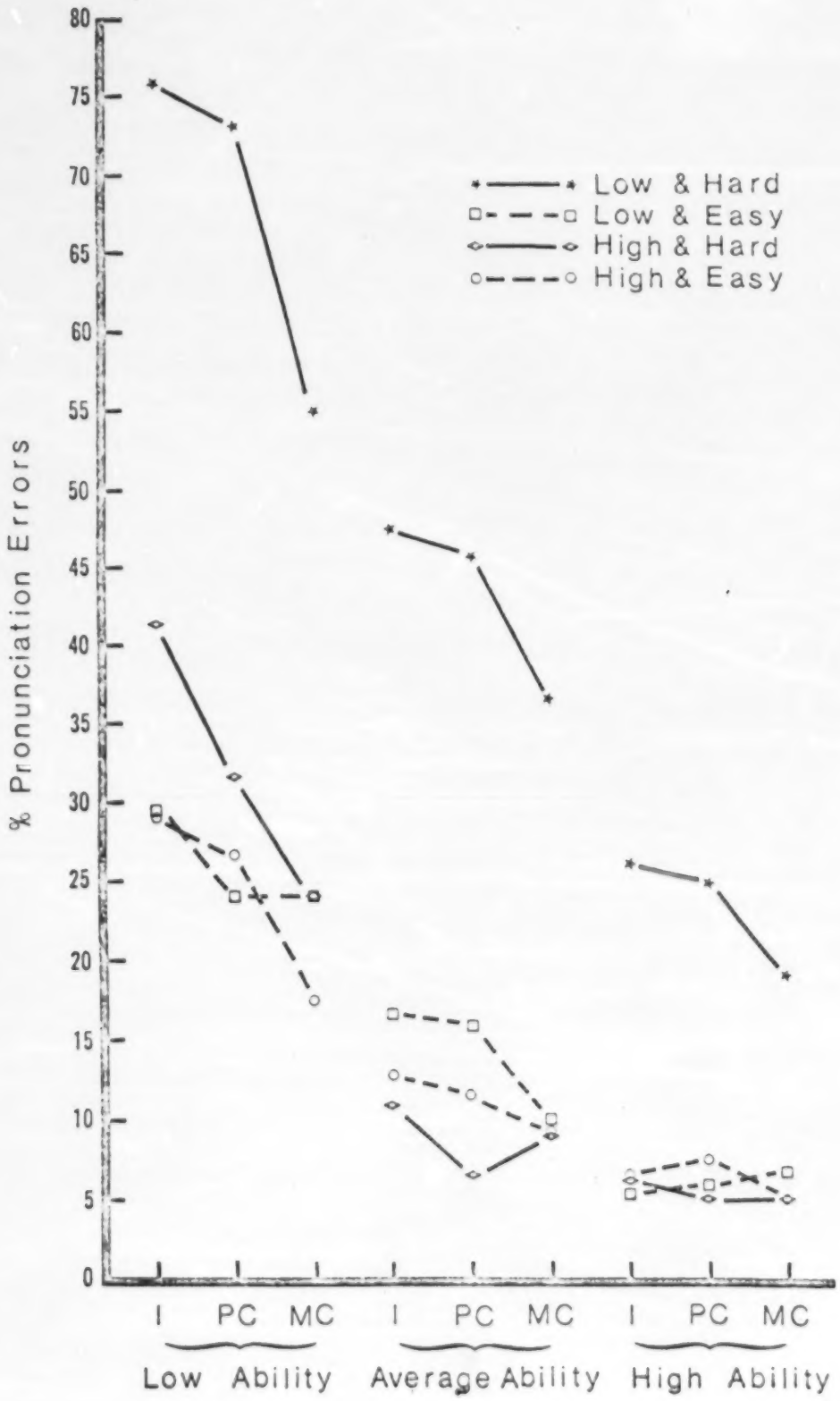

Figure 3: Frequency x decodability interaction for isolation, poor context, and moderate context.

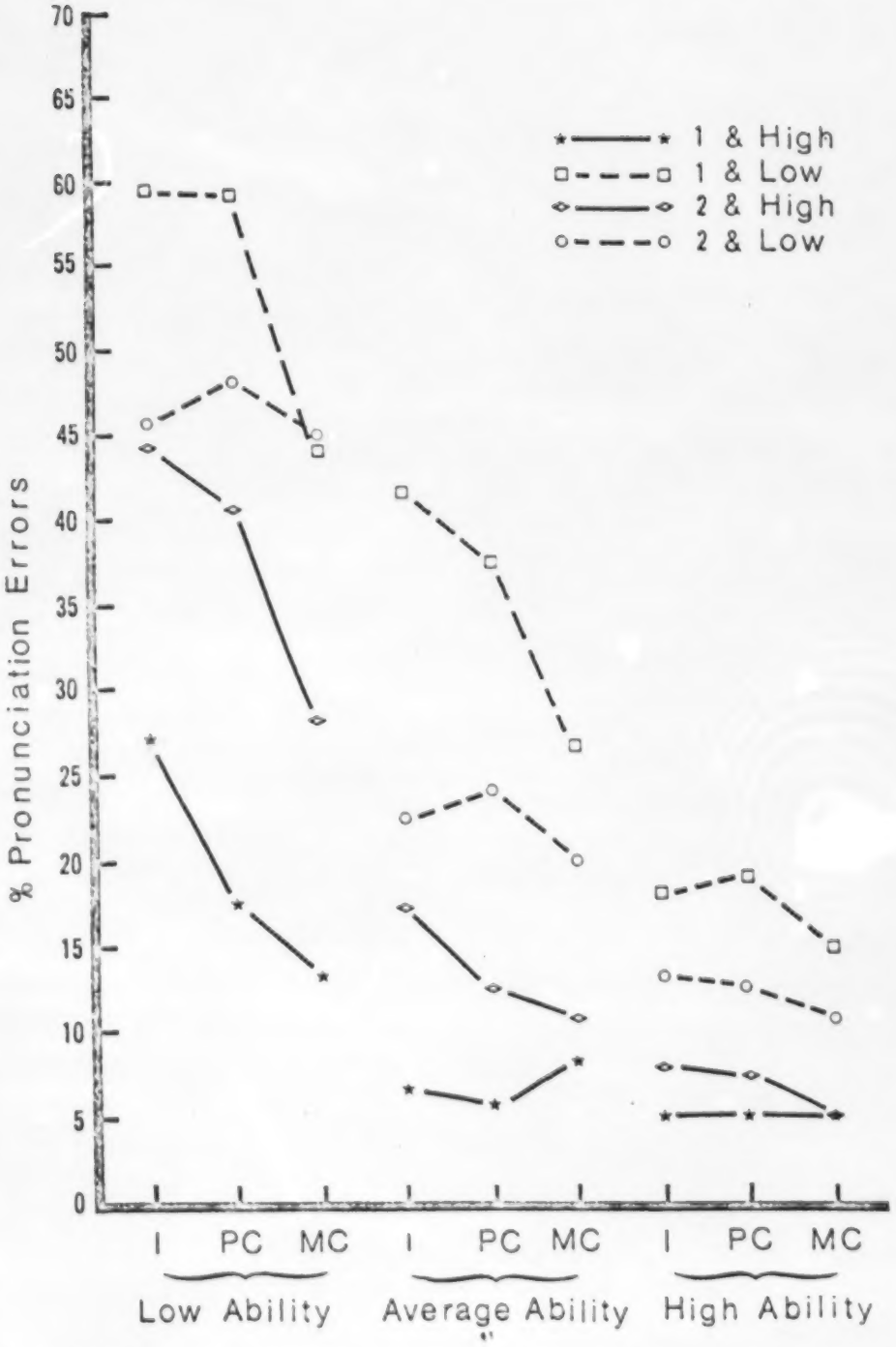

Figure 4: Syllables x frequency interaction for isolation, poor context, and moderate context.